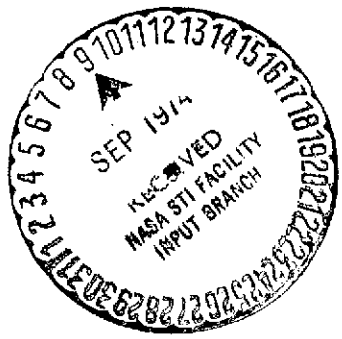
"SOYUZ"--WORKHORSE OF SPACE

G. Yelizavetin

Translation of: "'Soyuz'--Truzhenik Kosmosa". In: Grazhdanskaya Aviatsiya, No. 4, April 1974, pp. 22-23



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
WASHINGTON, D.C. 20546 AUGUST 1974

STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA TT F- 15754		

4. Title and Subtitle	5. Report Date
"SOYUZ"--WORKHORSE OF SPACE	August 1974
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
G. Yelizavetin	
	10. Work Unit No.

9. Performing Organization Name and Address	11. Contract or Grant No.
LINGUISTIC SYSTEMS, INC. 116 AUSTIN STREET CAMBRIDGE, MASSACHUSETTS 02139	NASW-2482
	13. Type of Report & Period Covered
	TRANSLATION

12. Sponsoring Agency Name and Address	14. Sponsoring Agency Code
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION WASHINGTON, D.C. 20546	

15. Supplementary Notes

Translation of "'Soyuz'--Truzhenik Kosmosa". In: Grazhdanskaya Aviatsiya, No. 4, April 1974, pp. 22-23

16. Abstract

During its flight of Sept. 1973, Soyuz 12 served as an astrophysical laboratory. Experiments were conducted in which spectrograms were taken of the earth's surface to locate mineral resources, and investigations of the earth's atmosphere were made. Aboard Soyuz 13, launched on Dec. 18, astrophysical observations of stars in the ultraviolet range were conducted. Tests were made on the derivation of needed protein within the life-support system of the vehicle and the circulation of the brain was measured using the Levka apparatus.

17. Key Words (Selected by Author(s))	18. Distribution Statement
	UNCLASSIFIED - UNLIMITED

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
UNCLASSIFIED	UNCLASSIFIED		

WORKHORSE OF THE UNIVERSE

G. Yelizavetin

The space vehicle Soyuz is a multipurpose workhorse of the universe. It can be equipped with complex scientific research instruments for missions that can last for many days, and it can be used as a cosmic "bus" for bringing cosmonauts to orbital work stations. In the summer of 1974 this type of space vehicle will be launched into space to rendezvous with the space vehicle of another space power--the American Apollo.

This past fall Soyuz took on one more function. It became an astrophysical laboratory. The scheduled space vehicle Soyuz 12 was rocketed into an orbit around the earth from the Baykonur spaceport on 27 September 1973. Its mission--under the command of Lt. Colonel V.G. Lazerev and flight engineer O.G. Makarov was to test over a two day period the improved vehicle flight systems to work out manual and automatic control systems for various flight conditions and to take spectrographs of individual sections of the earth's surface.

For two years engineers and designers have been carefully examining all parts of the vehicle structure. All decisions were verified experimentally both on the ground and in flight. The next step had to be done under actual space flight conditions.

A small flight delay allowed development people to decide on whether to fire the vehicle without solar batteries; power reserves on board the Soyuz 12 were adequate.

It is difficult to recall another such launch where there was such an abundance of things to do in orbit. Getting

accustomed to the conditions of weightlessness, cosmonauts V.G. Lazerev and O.G. Makarov set about to do the large amount of intensive work according to the flight program. On the third orbit, the "space armor"--the space suits--were taken off, dried out with hot air and then stowed in special packs. The cosmonauts put them on again just before returning to earth.

The first orbit of the space vehicle Soyuz 12 was elliptical. The cosmonauts then shifted the vehicle to a new and more circular orbit. The cosmonauts were able to execute a series of maneuvers before losing visibility in the USSR.

After resting for the "night" the cosmonauts started to carry out the second day's schedule. It was completely loaded with experiments. Orbital corrections were made during orbital maneuvers. A test was made of the system used to verify the correct operation of the automatic space vehicle steering system.

Dawn arrived and the Chief of the Center for Training Cosmonauts, Aviation Major General G.T. Beregov, twice decorated as a Hero of the Soviet Union, noted the high professional skill of cosmonauts V.G. Lazerev and O.G. Makarov who were managing a huge amount of strenous work during a short space flight. Experiments followed one after another.

The flight engineer was at the space vehicle's porthole. In his hands was a nine objective lens camera. An experiment was conducted, in which spectrograms were being taken of the earth's surface. Objective lens filters make it possible to take pictures of various portions of electromagnetic radiation--from visible to infra-red regions. These pictures are needed for national economic purposes. In the near future it will reduce the need for large numbers of geological expeditions. Invest-

igations of the earth conducted by a man in space make it possible to fix with a great deal of precision the location of mineral resources. By this method it is possible to locate reserves of pure water, so greatly needed at the present time. Foresters will have a complete picture of vegetation and so forth. An aerial survey of several well-known territories within the country were made simultaneously with those of Soyuz 12. A comparison of pictures taken from space with those from the flight survey will make it possible to evaluate the transmissive properties of our planet's atmosphere. Throughout the course of the entire flight, the cosmonauts made observations of meteorological conditions over land and sea.

By means of night vision devices, V.G. Lazarev and O.G. Makarov conducted experiments in space vehicle orientation. Without question, their tests will help to facilitate and extend the capabilities of future flights.

Two and one half months after the flight of Soyuz 12, on December 18, the Soyuz 13 space vehicle, scheduled for a broad program of scientific and technical investigations and experiments was put into an earth orbit in the Soviet Union. Cosmonaut-pilot Major P.I. Klimuk and flight enginner V.V. Lebedev piloted the craft.

Probably the most important operation aboard Soyuz 13 was the experiment on the astrophysical observation of stars in the ultraviolet range. This was done with an Orfon -2 telescope system which is a combination of optical, mechanical, and electronic devices installed in an external vehicle compartment where the docking assembly is normally located. This system of telescopes was able to operate in the severe space environment

because the entire apparatus, except for object lenses, was enclosed in a special, hermetically sealed jacket.

Cosmonauts P.I. Klimuk and V.V. Levedev adjusted the Orion-2 on the first day of flight. The astrophysical device was controlled in the following manner: The commander turned the space vehicle about so that the instrument's objective lenses were aimed at that section of the heavens which had been spectrographed and programmed in advance. The flight engineer watching through the porthole corrected the motion and searched out the reference star in the sky. Upon sighting it, he manipulated the viewfinder so that one of the star detectors latched onto this star. The second detector, set at a large angle away from the first, holds a second reference star in its field of view. The telescope system is connected directly to a unique three-axis, stabilized platform which is accurate to several arc seconds. Spectrograms were made automatically and the exposure was set by the brightness of the objective lens.

P.I. Klimuk and V.V. Lebedev received substantial training in one of our country's observatories. They studied the firmament so well that they were able to forego the use of special star charts in flight when searching for heavenly bodies that were to be photographed. The cosmonauts were able to take spectrograms in the ultraviolet range of more than 3000 stars of various magnitudes up to the 12th magnitude and, in one case, even greater. Depending on the types of star spectrograms, scholars are able to solve many problems about the stellar universe and astrophysics in particular, to determine whether themonuclear processes take place in the outer stellar regions or within their cores.

In addition to the astrophysical observation of stars, the experimental program called for photographing separate sections of

the earth's surface to help meet national economic needs. Scholars must know the spectral characteristics of the underlying surfaces of the earth under various illumination conditions and camera angles as a function of the atmosphere as well as other factors.

Space travel has required great efforts and large expenditures from mankind. As a natural consequence of scientific research processes, space investigations now influence the accelerated development of science and technology and enrich them with new ideas, all of which affect to a considerable extent various parts of our daily lives.

Cosmonauts will not take on large stores of provisions for distant stellar voyages. They will derive basic food needs directly from the space vehicles. To achieve this purpose, experimenters have spent many months on earth in closed cycle life-support systems. The cosmonauts then corroborate their conclusions in orbit. For example, during the eight-day flight of Soyuz 13, an experiment was done on synthesizing protein. The closed ecological system in which a microorganismal biomass was grown was called Oasis in our country. In principle, it works approximately like this. Two vessels, one of which contains hydrogen-oxygen producing bacteria, the other containing urobacteria, are connected by a tube. The microorganisms were put into an anabiotic state, before the space vehicle was launched to cancel the effect of acceleration before reaching orbit. An electrolytic process takes place in the first vessel, where water is decomposed into hydrogen and oxygen. The bacteria in this vessel feed on hydrogen and use the oxygen for breathing. The urobacteria in the second container are in a solution of urea and other minerals. To grow, it also must use the oxygen which emanates from the first vessel.

'The by-product of urobacteria--carbon-dioxide gas--is

assimilated by the bacteria in the first container. A mutually dependent ecological system is formed in which both types of organisms provide the necessary living environment for one another. The Oasis-2 apparatus was used on Soyuz-13. The cosmonauts turned it on during the first day of flight and released the end-products and replenished the food supply throughout the entire period of flight.

We are not exactly sure how to evaluate this organism type device under weightless conditions. Therefore, there are medico-biological experiments on every flight--whether short or long.

Experiments were done onboard the Soyuz-13 using the Levka apparatus. It was used to study circulation in the brain during various periods of activity of the organism.

This apparatus works on the principle of measuring the electrical resistance of the brain at high frequency. Cosmonaut V.V. Lebedez conducted this experiment while resting and after manipulating a fifteen kilogram expander for one minute. A telemetry unit relayed results of the experiment to earth. Medical personnel were satisfied with the operation of the Levka in orbit. After all parts of the program were completed the space vehicle Soyuz-13 with the cosmonauts onboard made a soft landing in a specified area of the Soviet Union.

There are new launchings planned for the future. Unlimited cosmic distances wait for their explorers. And seeing off the new cosmonauts, the launching crews of the Baykonur spaceport will add many more stars to the launching installation.